

## PATENT COOPERATION TREATY

## PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT  
(PCT Article 36 and Rule 70)


Applicant's or agent's file reference F17326	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/IB 03/02032	International filing date ( <i>day/month/year</i> ) 27.05.2003	Priority date ( <i>day/month/year</i> ) 31.05.2002
International Patent Classification (IPC) or both national classification and IPC A43B3/00		
Applicant CSIR et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
  - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  12.11.2003	Date of completion of this report  04.10.2004
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Vesin, S  Telephone No. +49 89 2399-7489



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB 03/02032

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, Pages

2-14 as published  
1, 1a received on 13.09.2004 with letter of 10.09.2004

### Claims, Numbers

1-25 received on 13.09.2004 with letter of 10.09.2004

### Drawings, Sheets

1/2-2/2 as published

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/IB 03/02032**

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-11
	No: Claims	12-14
Inventive step (IS)	Yes: Claims	1-11
	No: Claims	12-15,17-18,25
Industrial applicability (IA)	Yes: Claims	1-25
	No: Claims	

2. Citations and explanations

**see separate sheet**

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty,  
inventive step or industrial applicability; citations and explanations  
supporting such statement**

**1. State of the art**

- 1.1 The amendments filed with the letter dated 10.09.2004 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT. The amendments concerned are the following:

In claim 1, line 18, the term "*inhibiting*" qualifying the propagation of any said stray component has replaced the original word "*attenuating*". There is no basis for such amendment in the original disclosure and it is believed that inhibiting is stronger than only attenuating a propagation. On line 20, the passage "*low acoustic speed lower than 200 m/sec*" has been replaced by "*low acoustic speed*". This generalisation is not allowable and further since only the relative adjective "*low*" qualifies the speed, it renders the claim unclear (Art.6 PCT). This also applies to claim 12, line 15.

In claim 3, there is no basis for claiming an acoustic speed "*at least as high as the acoustic speed of glass*". The same applies for claim 14.

In claim 12, line 12, the "*solid material*" for the shock wave guide member has been generalised to a "*material*". This is not allowable.

**2. Independent claim 1**

- 2.1 The subject-matter of independent claim 1 is without doubt novel in the sense of Article 33(2) PCT, since its features as a whole are not known from the documents found in the search report.
- 2.2 Document **US-A-3 243 898 (D1)** shows a method of protecting a foot from effects of a landmine including:  
guiding shock waves obliquely away from said foot by means of an obliquely oriented shock wave guide member 2 embedded in a sole volume (see figures 3 and 7; col.2, line 50 - col.3, line 7), the shock wave guide member 2 being of a material having an acoustic speed of at least more than 3000 m/s (aluminium,  $v=6420$  m/s, col.2, lines 32-34);

attenuating propagation of any stray component of the shock waves in a direction toward said foot in the sole volume of the article of footwear by means of a layer 8 (See fig.3) of material having a low acoustic speed lower than 200 m/s (col.3, lines 2-7 and 53-54) arranged between the shock wave guide member and an innersole of the article of footwear.

- 2.3 The problem to be solved by the present invention may therefore be regarded as protecting the foot from the effect of the shock waves created by an explosion.
- 2.4 This problem is solved by the present computer furniture system<sup>2</sup> as defined by the features combination of claim 1:
- the material of the shock wave guide member is cracked at a speed of crack progression lower than its acoustic speed;
  - and is further spalled at a downstream end of the shock wave guide member to create a path of lesser resistance for a blast following the shock wave;
  - the blast follows said path; whereby the cracked material has to be removed to render said path open;
  - Stray components of the shock wave are then deflected in the guide member.
- 2.5 None of the remaining available prior art discloses or suggests the distinguishing features of claim 1.
- 2.6 Thus, the subject-matter of independent claim 1 also involves an inventive step in the sense of Article 33(3) PCT.

3. Dependent claims 2-11

The same conclusion must also apply to dependent claims 2-11, which constitute various embodiments of the claims to which they refer.

4. Independent claim 12

- 4.1 The present application does not meet the requirements of Article 33(1) PCT, because the subject-matter of claim 12 is not novel in the sense of Article 33(2) PCT.
- 4.2 Document **D2** shows an article of footwear comprising the features defined in claim 12 (see page 5, lines 9-17 and p.6, line 23 to p.7, line 13).

In particular, this document shows an article of footwear having a shock wave guide member 5,8,16b partly made of steel, which is believed to be prone to cracking at a crack propagation velocity lower than its acoustic velocity\*. It also shows a blocking material having a low acoustic speed (see plug 19)

\* *crack propagation velocity* as well as *acoustic velocity* are material characteristics which depend on environmental conditions such as temperature, pressure and stresses (for crack propagation). Since none of these important parameters are defined in the claim, the invention is not sufficiently disclosed to enable the skilled man to perform the invention (Article 5 PCT).

5. Dependent claims 13-25

- 5.1 Dependent claims 13-15, 17-18 and 25 appear to relate to minor constructional features which, insofar as not directly disclosed in the prior art revealed in the present application or in the search report, represent obvious modifications thereof. Such features will be selected and used by a man skilled in the art when he needs them, and appear not to involve an inventive step within the meaning of Article 33(3)PCT when combined with the subject-matter of claim 12.
- 5.2 However, the combination of the features of dependent claim 21 is neither known from, nor rendered obvious by, the available prior art. It is suggested therefore that a new independent claim 17 be drafted to include these features, bearing in mind that the features known in combination in D1 or D2 should be placed in the preamble of such a claim in accordance with Rule 6.3(b) PCT. Those dependent claims which are consistent with such a new independent claim could be appended thereto, provided that the resulting combination of features has been disclosed in the application as originally filed.

PROTECTIVE FOOTWEAR

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This invention relates to protective footwear. It relates more specifically to an article of footwear for protecting a wearer against the effects of a landmine explosion, especially an anti-personnel landmine explosion.

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US Patent 3 243 898 discloses an underfoot attachment device having a V-shaped deflector or wedge of substantially un-deformable metal having an inverted apex extending centrally along a length of a footprint of a user. The deflector is contained along its bottom and outsides in a block of balsa wood, is internally filled with an acoustic filler, and is contained in a plastic hull.

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The deflector is intended to deflect the force of an exploding mine away from a foot and limb of a user.

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WO 01/18479A1 discloses an article of footwear including a lower matrix underneath a foot of a wearer, an outer hard shell around the foot, and an upper protective surround around a lower portion of a leg of the wearer. The matrix incorporates a substantially non-deformable deflector in the form of a metal sheet oriented obliquely upwardly to deflect an up-welling result of an exploding landmine obliquely laterally. Underneath the deflector is provided a layer of "DETSHEET", a detonation material adapted to detonate when subjected to shock and pressure waves of an exploding landmine, to dissipate the first shock and pressure waves and, to some extent, subsequent effects of the explosion. Layers of a frangible material are provided above the deflector and below the "DETSHEET". Laminated sheets of Kevlar impregnated fabric of wedge shape, and a plug of energy dissipating material, followed by an open honeycomb structure are provided in superimposed arrangement between the deflector and an inner sole of the article of footwear. A sock of soft foam material

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surrounds the foot and lower leg and acts as a soft lining underneath the hard outer shell and protective surround.

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Although the Applicant does not wish to be bound by theory, it is nevertheless believed that a theoretical explanation of some concepts relating to the effects of a landmine explosion will assist the reader in appreciating the inventive contribution which the inventors have made and the principles underlining this invention. Thus, some concepts of relevance are briefly explained.

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The Applicant has appreciated that shockwaves play an important role in the field of the invention and, in contra distinction to other inventors in the field, has focused efforts in understanding and dealing with the shock wave effect of a landmine explosion.

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Shock waves are in certain respect equivalent to acoustic waves, for example, progression of a shock wave through a material is not associated with transfer of mass or particles, it progresses as a wave. Furthermore, the speed of progression through a material is dependent on physical properties of the material, i.e. in the case of solid material, speed is proportional to the density and inversely proportional to the Young's modulus of the material. Yet further, the Applicant has appreciated the significance that speed of progression through liquids differ, and is generally lower than that through "rigid" solids such as ceramics, metals, and the like, but generally higher than through gasses such as air. Yet further, the role that temperature of a gas plays in respect of acoustic

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**CLAIMS:**

1. A method of protecting a foot of a human from effects of a landmine explosion underneath said foot, including

5 guiding shock waves caused by the landmine explosion obliquely away from said foot by means of a correspondingly obliquely oriented shock wave guide member embedded in a sole volume of an article of footwear worn by the human, the shock wave guide member being of a material having an acoustic speed of at least more than 3000 m/sec;

10 cracking the material of the shock wave guide member by means of said shock waves at a speed of crack progression lower than the acoustic speed of said material of the shock wave guide member, and spalling said material at a downstream end of the shock wave guide member to create a path of lesser resistance for a blast following the shock waves;

15 causing said ensuing blast following the shock waves to follow said path of lesser resistance and removing said cracked material to render said path open;

deflecting any stray component of the shock waves back into the guide member and inhibiting propagation of any said stray component of the shock waves in a direction toward said foot in the sole volume of the article of footwear  
20 by means of a layer of material having a low acoustic speed arranged between the shock wave guide member and an inner sole of the article of footwear.

2. A method as claimed in Claim 1 in which guiding the shock waves is obliquely laterally outwardly in accordance with an oblique outward orientation  
25 of the shock wave guide member.

3. A method as claimed in Claim 1 or Claim 2 in which the shock wave guide member is selected to have an acoustic speed at least as high as the acoustic speed of glass.

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4. A method as claimed in any one of Claim 1 to Claim 3 inclusive which includes absorbing heat energy by evaporating liquid contained in the sole volume.

5. A method as claimed in Claim 4 in which the liquid is proximate the guide member.

6. A method as claimed in any one of Claim 1 to Claim 5 inclusive, in which said guiding of the shock waves, cracking of the shock wave material and creating a path of lesser resistance take place in composite fashion along a plurality of paths alongside one another by means of a composite shock wave guide member having a plurality of shock wave guide elements alongside one another.

7. A method as claimed in Claim 6 in which each shock wave guide element is in the form of a strip of rigid glass containing material, the strips being oriented transversely to allow bending of the article of footwear along transverse bend lines intermediate adjacent strips.

8. A method as claimed in any one of Claim 1 to Claim 7 inclusive in which said layer of material having a low acoustic speed is in the form of vermiculite, or a composite material containing vermiculite.

9. A method as claimed in any one of Claim 1 to Claim 8 inclusive, which includes enhancing shock wave progression downstream of the foot by means of a layer of soak-out material in close contact with skin along a foot surface opposite a sole of the foot, the layer of material having an acoustic speed at least equal to acoustic speed of flesh.

10. A method as claimed in Claim 9 in which the acoustic speed of said soak-out material is higher than the acoustic speed of water.

11. A method as claimed in Claim 9 or Claim 10 which includes containing the layer of soak-out material in association with a sock worn by the human.

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12. An article of protective footwear for a human having a composite sole including an outer sole along one extremity of the article of footwear, a spaced inner sole for seating a foot of a user, and a sole volume intermediate the outer and the inner soles, the composite sole including in said sole volume

10 a shock wave guide member oriented to guide shock waves caused by a landmine explosion obliquely away from said foot in use, the shock wave guide member being of a material which has an acoustic speed at least higher than 3000 m/sec and which is prone to being cracked by shock waves at a speed of crack progression lower than its acoustic speed;

15 a layer of blocking material having a low acoustic speed between the shock wave guide member and the inner sole.

13. An article of footwear as claimed in Claim 12 in which the shock wave guide member extends from a laterally inner position proximate the outer sole obliquely upwardly to a laterally outward extremity of the composite sole.

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14. An article of footwear as claimed in Claim 12 or Claim 13 in which the shock wave guide member is of solid material having an acoustic speed at least as high as the acoustic speed of glass.

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15. An article of footwear as claimed in Claim 14 in which the shock wave guide member is of, or contains, a material selected from glass and a ceramic material.

16. An article of footwear as claimed in any one of Claim 12 to Claim 15 inclusive in which the composite sole volume contains a liquid proximate the shock wave guide member.
- 5 17. An article of footwear as claimed in any one of Claim 12 to Claim 16 inclusive, in which the shock wave guide member is of composite structure comprising a plurality of shock wave guide elements extending alongside one another.
- 10 18. An article of footwear as claimed in Claim 17 in which each shock wave guide element is in the form of a strip of rigid material selected from glass or glass containing material, or a ceramic material, the strips being oriented transversely and arranged adjacent one another to allow bending of the article of footwear along transverse bend lines intermediate adjacent strips.
- 15 19. An article of footwear as claimed in any one of Claim 12 to Claim 18 inclusive in which the blocking material is vermiculite, or a composite material containing vermiculite.
- 20 20. An article of footwear as claimed in any one of Claim 12 to Claim 19 inclusive which includes a foot surrounding upper defining a foot cavity above the inner sole, and a layer of soak-out material in fluid form and having an acoustic speed equal to or higher than the acoustic speed of flesh and arranged to be in close contact with skin at a surface of the foot opposite a sole of the foot in use.
- 25 21. An article of footwear as claimed in Claim 20 in which the soak-out material has an acoustic speed higher than that of water.
22. An article of footwear as claimed in Claim 21 in which the soak-out
- 30 material is or includes glycerin.

23. An article of footwear as claimed in Claim 20, Claim 21, or Claim 22 in which the soak-out material is contained in a closed, flexible container such as a pad or sachet.
- 5 24. An article of footwear as claimed in any one of Claim 20 to Claim 23 inclusive in which the soak-out material is provided in amongst granular or filamentary material having an acoustic speed higher than the acoustic speed of the soak-out material.
- 10 25. The combination of an article of footwear as claimed in any one of Claim 20 to Claim 24 inclusive, and a sock, in which the soak-out material is contained in the sock.